

Interactive comment on “Statistical estimation of global surface temperature response to forcing under the assumption of temporal scaling” by Eirik Myrvoll-Nilsen et al.

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We thank the reviewer for the comments. We agree that the 1-box model is not an adequate benchmark for the model we use. Our idea was to use it more for illustration since it is a well-known simple climate model. In our revised manuscript, we will make this clearer. Moreover, we will incorporate a 2-box model to the analysis, as suggested by the reviewer.

The second main point the reviewer makes is that we should compare the model's temperature projections to ESM temperature projections (under RCP scenarios) after we have tuned the statistical model historical runs of the corresponding EMSs. We

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agree that this is a reasonable way of testing the model, and we will incorporate the analyses in the revised manuscript. The results show that the predictions made using the statistical model slightly overestimate the temperature increase in the ESMs. This overestimation is not a statistical bias. Instead, it shows that scale invariance is too crude an approximation for several ESMs. However, not all climate models have scaling properties consistent with temperature reconstructions, and hence one should be careful in how one interprets the apparent overestimation.

Response to the last paragraph in the review:

The uncertainties illustrated in figure 2 describe only the uncertainty of the estimated forced response. The remaining noise term also affects the temperature.

The explanation for the difference in uncertainties in the panels of figure 2 is simply that noise-free response to the known forcing gives a much better fit for the scaling model compared to the model with an exponential response model. It is an illustration of the well-know inadequacy of the 1-box model.

The uncertainty bars in figures 4 and 5 describe the total uncertainty of the model, not just that of the forced temperature response, which we show in figure 2. We will make this clearer in the revised manuscript.

We will also add error bars for figure 6.

Interactive comment on Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2019-66>, 2019.

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